

RESEARCH NOTE

Giant African snail, *Achatina fulica*, as a snail predator

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Abstract: Individuals of *Achatina fulica* (Bowdich, 1822) were observed preying on veronicellid slugs at two sites on the island of Oahu, Hawaii. As such, the presence of *A. fulica* may pose a greater threat to terrestrial mollusc conservation than previously imagined. It is our hope that this note provides some impetus for other researchers to explore the possible predation impacts of introduced populations of *A. fulica* and to consider the possibility that other introduced snails and slugs may be having as yet unforeseen or unnoticed impacts.

Key words: predation, introduced, invasive, alien species

Invasive species are recognized globally as a major threat to biodiversity and ecosystem health (Carlton and Geller 1993, Lydeard *et al.* 2004, Pimentel *et al.* 2005). Numerous non-native plants and animals have been implicated in the extirpation of native taxa (Vitousek *et al.* 1997, Gurevitch and Padilla 2004). However, it is difficult to assign causality to one factor such as invasive species and ignore others, *e.g.*, habitat modification and climate change (Gurevitch and Padilla 2004). Furthermore, knowledge of life histories and behavioral characteristics of alien species is usually based on studies in their native range, making it difficult to predict the interactions of a particular alien species after introduction to a new region. As such, many unpredicted interactions may occur and possibly go unnoticed. Here we report on one such interaction involving the giant African snail, *Achatina fulica* (Bowdich, 1822), in Hawaii that has gone unreported for more than half a century. We also comment on the possible implications of this interaction with native species in Hawaii as well as in other parts of the world where *A. fulica* has been introduced.

Achatina fulica is one of the largest land snails in the world, reaching up to 19 cm in length (Peterson 1957). In part because of its polyphagous diet, it has become recognized as one of the world's most damaging pests and is listed in the Global Invasive Species Database (<http://www.issg.org/database/welcome/>) among "One hundred of the world's worst invasive alien species" (Lowe *et al.* 2000). In addition, this snail is known as a vector of at least two human disease agents: the rat lung-worm *Parastrongylus* (= *Angiostrongylus*) *cantonensis* (Chen 1935) and a gram-negative bacterium, *Aeromonas hydrophila*, which causes a wide range of symptoms (Mead 1956, 1961, Wallace and

Rosen 1969, Dean *et al.* 1970, Mead and Palcy 1992). Because of the snail's prominence as a pest and disease vector, a number of researchers have investigated its feeding and behavioral ecology in both the field and laboratory (Mead 1961, Pawson and Chase 1984, Tomiyama 1994). In addition to the 500 plant species that *A. fulica* is known to eat, the snail will also consume decaying and rotting vegetation, dung, garbage, wet paper and cardboard, dead animals, and crushed (*i.e.*, already dead) snails of its own kind (Srivastava 1992). Hence, it is surprising that no one has reported carnivorous behavior by this species in which it attacks, subdues, and consumes live prey. This note reports three instances of this predatory behavior on the island of Oahu, Hawaii. These observations are noteworthy because they indicate an alternative feeding mode for *A. fulica*, suggesting its potential to impact other species through predation.

Individuals of *Achatina fulica* were observed consuming veronicellid slugs (*Veronicella cubensis* (Pfeiffer, 1840)) at two sites on the island of Oahu (Fig. 1). Both sites were anthropogenically altered, in close proximity to housing and dominated by low shrubs. The first two observations were made in Kaneohe (21°25'02"N, 157°48'51"W) in November and December 2004. In both instances, an individual *A. fulica* (*ca.* 5 cm in shell length) was observed consuming a similar sized slug. No detailed observations were made during these first two observations.

Slug consumption by *Achatina fulica* was also observed in Hawaii Kai (21°16'12"N, 157°44'84"W) in September 2005. However, on this occasion, three smaller (10 to 15 mm in shell length) *A. fulica* were observed consuming one veronicellid slug (>5 cm in length) at the same time. In order to determine if *A. fulica* kills the slugs or whether it

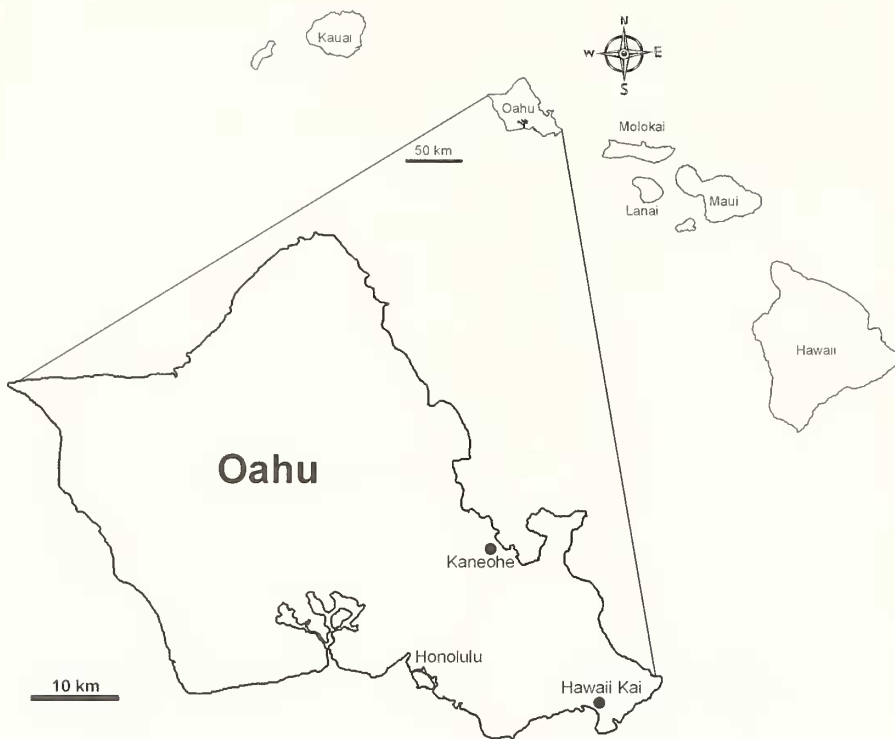


Figure 1. The two locations on Oahu (Kaneohe and Hawaii Kai) where *Achatina fulica* were observed consuming veronicellid slugs.

simply eats slugs that are already dead, a new live slug (2-3 cm in length) was collected and offered to the same three snails. It was quickly attacked by the three snails (Fig. 2). All three *A. fulica* climbed on top of the slug and proceeded to consume the integument of the slug. It took over five minutes for the snails to kill the slug. During the first three minutes, the slug crawled and pulled the snails with it as it moved. In the last two minutes, the slug seemed distressed and tried to curl up. After the slug stopped moving, the snails continued to consume the slug for a few minutes. The remainder of the slug (mostly the integument) was left in the glass dish for one day after the attack to confirm that it was actually dead.

In many low lying areas around Oahu, *Achatina fulica* and veronicellid slugs occur sympatrically. The fact that these observations have been made at different locations on the island suggests that predation by *A. fulica* on veronicellids may be common; yet an extensive literature search failed to find any previous description of this behavior. *Achatina fulica*, native to east Africa, has been introduced to many locations throughout the tropics and subtropics (Mead 1961, Mead and Palcy 1992). Given its anthropogenic distribution, it seems possible that this behavior might not be restricted to the Hawaiian Islands and to predation on veronicellid slugs.

As such, the presence of *Achatina fulica* may pose a greater threat to terrestrial mollusc conservation than previously imagined. This may be especially true because *A. fulica* has become established in areas that harbor a signifi-

cant portion of the world's molluscan biodiversity and *A. fulica* populations in these areas can attain extremely high densities. For example, *A. fulica* was introduced to Brazil in 1988 and has now been recorded in 23 out of 26 states in



Figure 2. Three *Achatina fulica* consuming a slug that was offered after the initial observation in Hawaii Kai on September 18, 2005.

that country (Thiengo *et al.* 2007). A similar rapid spread took place after its introduction to Hawaii in the 1930s (Cowie *et al.* 1995). Both Brazil and Hawaii are known to have a wealth of land snail diversity. However, in Brazil there are many native slug species, although there are none in Hawaii (Cowie *et al.* 1995, Lewinsohn and Prado 2005). Kekaouha (1966) estimated that there were 537,600 *A. fulica* in 6.72 hectares (7.75 snails per m²) in Hawaii, demonstrating the high densities this snail can attain in its introduced ranges. Although any statement on the impact of *A. fulica* predation on species in its newly established areas would be speculative, it seems possible that *A. fulica* could deleteriously impact the land snail fauna through competition and predation in areas where it has become established.

It is our hope that this note provides some impetus for other researchers to explore the possible predation impacts of introduced populations of *Achatina fulica* and to consider the possibility that other introduced snails and slugs may be having as yet unforeseen or unnoticed impacts. As it is difficult to make strong conclusions from only few observations, we hope that this report motivates further research. Future experiments should address: (1) what proportion of *A. fulica* have this predatory trait? (2) what proportion of the *A. fulica* diet is obtained through predation? (3) how diverse are the prey? and (4) over what geographical range does *A. fulica* display predatory behavior?

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